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GRAPHIT - A PLOTTING ROUTINE FOR THE MONROE OPTICAL PRINTER.(U)
AUG 70 D M POTTER, G BOTSEAS, C J BECKER
UNCLASSIFIED NUSC-TM-2211-272-70 NL

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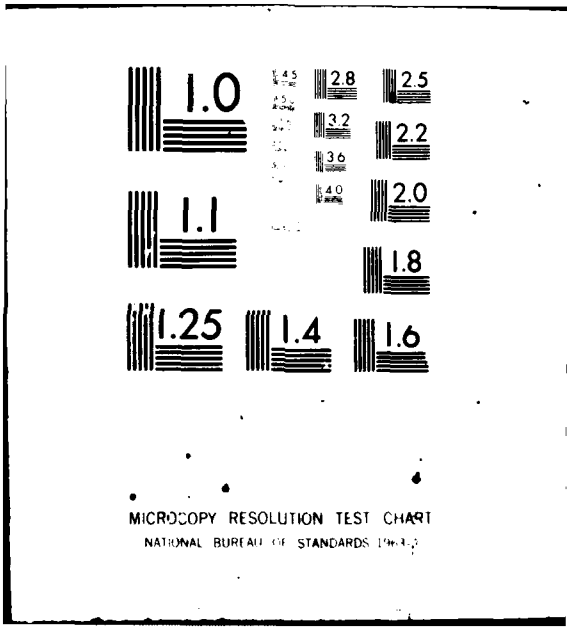
1.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS

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A-408-00-00 R2408

NEW LONDON LABORATORY
NAVAL UNDERWATER SYSTEMS CENTER
NEW LONDON, CONNECTICUT

GRAPHIT - A PLOTTING ROUTINE FOR THE MONROE OPTICAL PRINTER.

by

David M. Potter, George Botseas, and Clair J. Becker

NUSC/NL Technical Memorandum No. 2211-272-70

21 August 1970

INTRODUCTION

During the PARKA cruises of 1968 and 1969 propagation loss measurements were conducted in real-time using the UNIVAC 1230 computer system installed aboard USNS SANDS. The real-time analysis of the data demanded a quality control system which would enable the senior scientist to continually monitor the data as the experiment progressed. Procedure GRAPHIT was written to provide this capability. Under operator control, time series plots were displayed on the high speed Monroe optical printer. Any of the 200 available combinations of plots could be plotted, with each plot displaying the results of the latest 5 hours of data. Procedure GRAPHIT, its usage and theory of operation are described in this memorandum.

ADMINISTRATIVE INFORMATION

This memorandum was prepared under NUSC Project Title: Long-Range Acoustic Transmission Experiments for Surveillance Systems Development; R. Hasse and R. Martin, NUSC/NL Principal Investigators. The sponsoring activity was ONR, Code 102-OS, Dr. J. B. Hersey, Program Manager.

AVAILABLE GRAPHS

A total of two hundred different graphs are available to the requestor. They are as follows:

Propagation Loss	6 hydrophones	X	5 frequencies
Ambient Noise	6 hydrophones	X	5 frequencies
Signal-to-Noise Ratio	6 hydrophones	X	5 frequencies

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Propagation Loss Difference	6 hydrophones	X	5 frequencies
Angle of Arrival	4 hydrophone pairs	X	8 arrivals
Single Path Loss	6 hydrophones	X	8 arrivals

GRAPH FORMAT

Each graph contains the latest five hours of data plus whatever data has been taken during the present hour. Following the identification header, the data is graphed on the Monroe, one data point per line, six lines per inch. The data is scaled ten units (db or degrees) per inch. A grid and a reference line are also plotted. Appendix A contains a facsimile of a typical graph. (The dots do not produce such a blanketting effect on the Monroe printer).

Following the processing of each shot, the plot data was written on magnetic tape. At the end of each hourly sequence of shots, an end-of-file mark was written on the tape to provide a reference point.

OPERATOR USAGE

When a graph was desired, the computer operator entered the requests on the teletype.

When the computer honored the message, the message processor's executive routine (See NUSL Tech Memo 2211-100-70) called on routine GRAF, which would set bits, as indicated by the message, in the request cells for GRAPHIT. Following this, procedure GRAPHIT was called and outputted one graph. The graphs remaining on request were outputted at the discretion of the executive routine. See Appendix B for the message format and codes for the various graphs.

THEORY OF OPERATION

When GRAPHIT is called, it scans the request cells, searching for a non-zero word. If none is found, GRAPHIT exits. If a non-zero request cell is located, the routine transfers control to the appropriate labeling segment. Here the request cell is scanned for a set bit. The position of the set bit within the request cell supplies the program with the relative position of the data within the input buffer from magnetic tape as well as the hydrophone and frequency designations. The relative position of the data is converted to a core location by adding on the base address of the particular data block. This address is then stored in a specific location enabling the program to reference the correct data.

The program next prints the four-line identifying header. The first line gives the type of graph. The second line identifies the particular hydrophone-frequency or hydrophone-arrival combination. The third line gives the latest range value and the fourth the present date and time.

Next, a jump-table index is set, directing the program to the correct plotting segment after each data record is read.

The program back-reads the magnetic tape, counting records as it reads, until it encounters an end of file mark. Then five files are back-spaced. This positions the tape at the start of the latest five hours of data. The tape is now read forward, one record at a time. If a data record is read, the ASCII code for the plot symbol, either a D, representing a deep shot, or an S, representing a shallow shot, is put in the B5 register. The data value is rounded off to the nearest integer and is converted from dB or degrees to a printer column position by adding the proper conversion factor. The column position is placed in the B4 register. If it is a shallow shot, B4 is incremented by 20 so that the data is plotted 20 columns to the right of the deep shots. The 80 word output buffer is flooded with period codes. The grid symbols are placed every tenth column and a reference marker is placed in column 41.

If the data point falls outside the 80 word buffer, then the buffer is sent to the printer without the data point. Otherwise, the code for the data point is placed in the column position specified by B4 and the buffer is sent to the printer.

The read-print sequence continues until an end-of-file is detected. If it is not the sixth file mark, the read-print sequence continues. When the sixth file mark is detected, the backward record count is checked. If it is zero, the program exits. If it is not zero, another record is read, the data plotted and the backward record count is decreased by one. This continues until the count reaches zero. At this time the tape is back at its original position and the program exits.

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Computer Specialist

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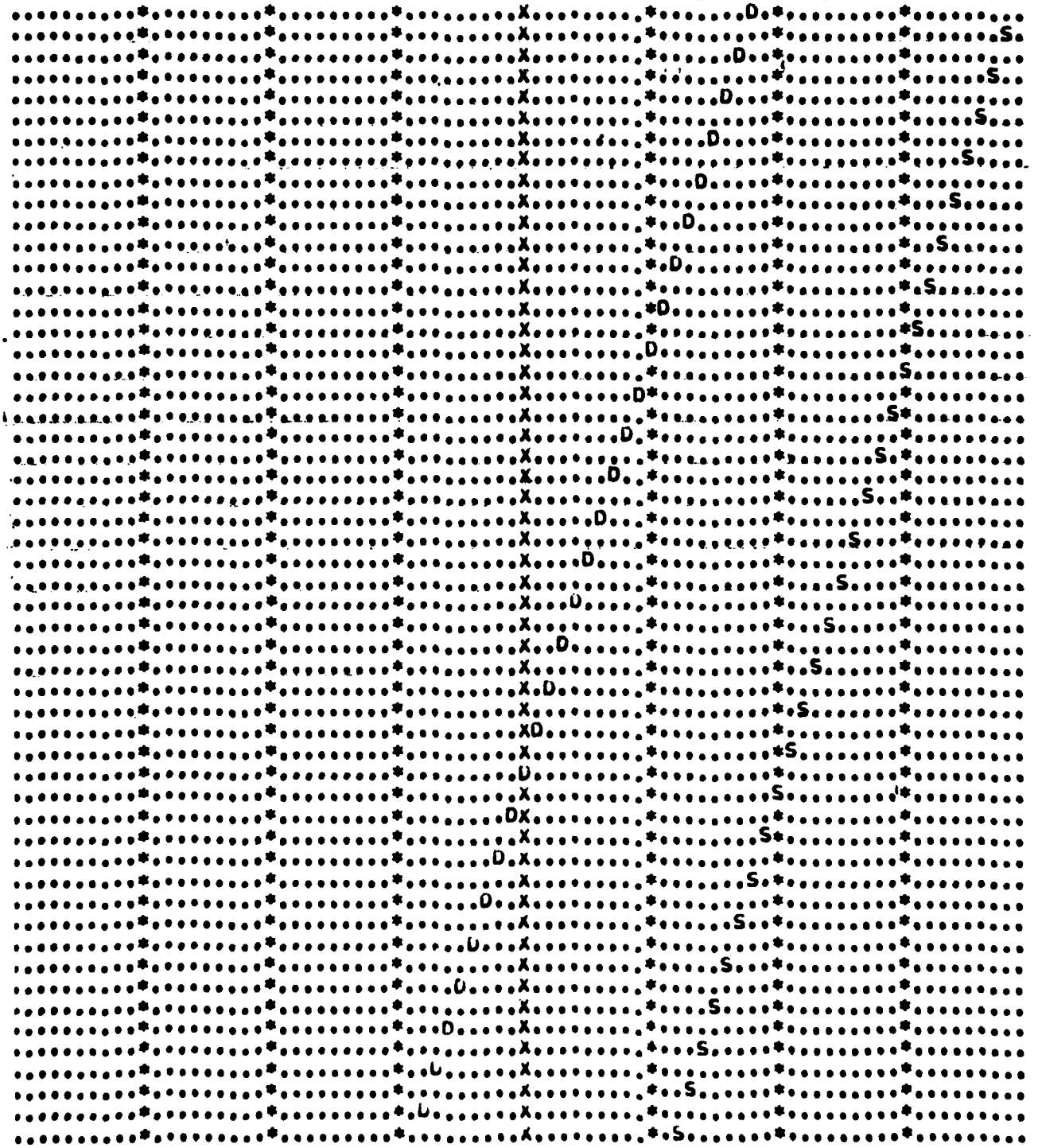
Appendix A

Sample Graph

PROPAGATION LOSS VS RANGE
HYDROPHONE NO 1 FREQUENCY 1
RANGE 1234.5
MONTH 1 DAY 2 HOUR 3 MINUTE 4 SECOND 5



Appendix B

Message Format

									REFERENCE LINE	
		F5	F4	F3		F2	F1		DEEP	SHAL
1	PROPLOSS	6 5 4 3 2 1	6 5 4 3 2 1	6 5 4 3 2 1	6 5	4 3 2 1	6 5 4 3 2 1		100	120
2	NOISE	6 5 4 3 2 1	6 5 4 3 2 1	6 5 4 3 2 1	6 5	4 3 2 1	6 5 4 3 2 1		-20	-40
3	S/N	6 5 4 3 2 1	6 5 4 3 2 1	6 5 4 3 2 1	6 5	4 3 2 1	6 5 4 3 2 1		10	-10
4	PROP DIF	6 5 4 3 2 1	6 5 4 3 2 1	6 5 4 3 2 1	6 5	4 3 2 1	6 5 4 3 2 1		0	-20
5	AOA	46 45 44 43 42 41 38 37 36 35	34 33 32 31 28 27 26 25 24 23			22 21 18 17 16 15 14 13 12 11			0	-20
6	AOA						48 47		0	-20
7	SIPLOSS	46 45 44 43 42 41 38 37 36 35	34 33 32 31 28 27 26 25 24 23			22 21 18 17 16 15 14 13 12 11			100	120
10	SIPLOSS			68 67 66 65 64 63 62 61		58 57 56 55 54 53 52 51 48 47			100	120
↑				F6						
Y	X →	35 34 33 32 31 30 27 26 25 24	23 22 21 20 17 16 15 14 13 12			11 10 7 6 5 4 3 2 1 0				

FORMAT FOR GRAPH MESSAGE IS: GRAF, $Y_1, X_1, Y_2, X_2, Y_3, X_3$ ETC.

LEGEND

SINGLE DIGIT NUMBERS ARE HYDROPHONE NUMBERS.

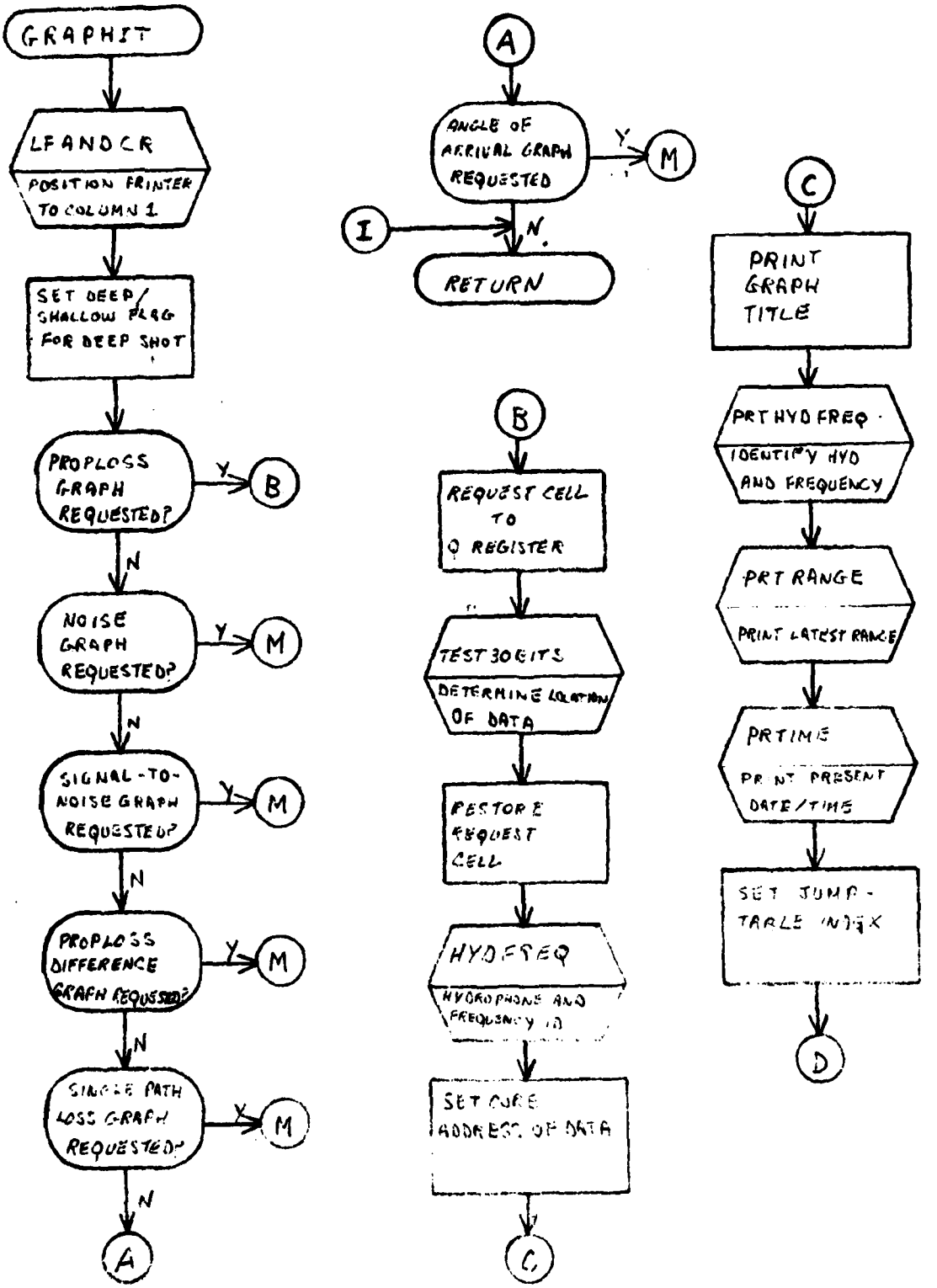
TWO DIGIT NUMBERS:

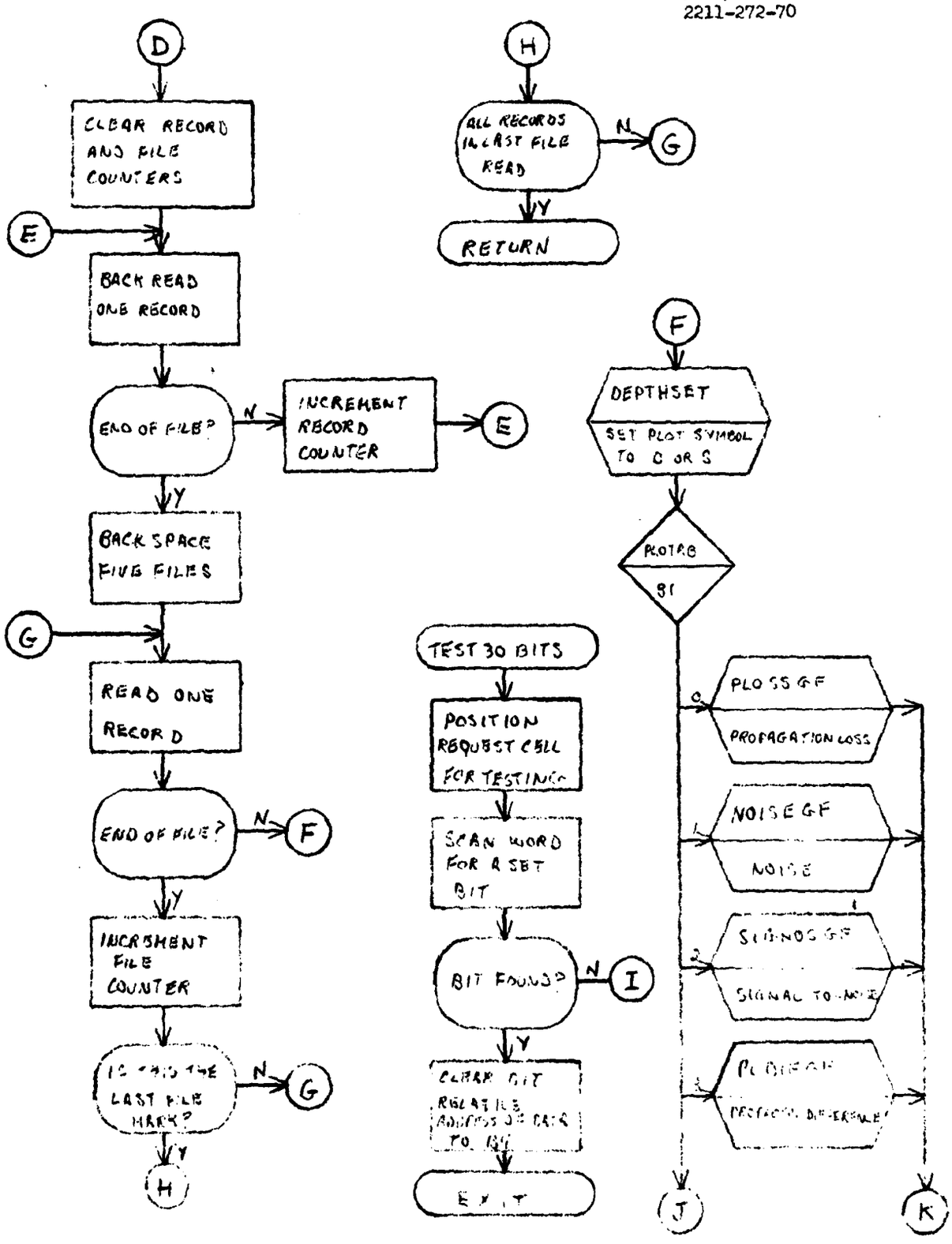
FIRST DIGIT IS HYDROPHONE PAIR NUMBER (AOA) OR HYDROPHONE NUMBER (SIPLOS).

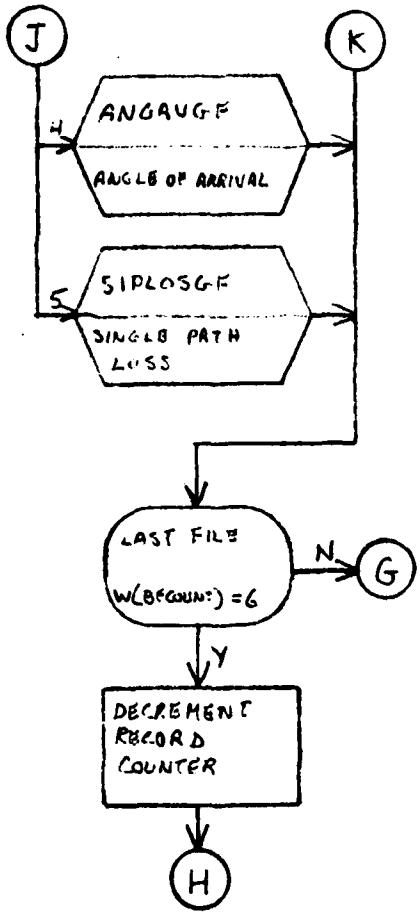
SECOND DIGIT IS ARRIVAL NUMBER.

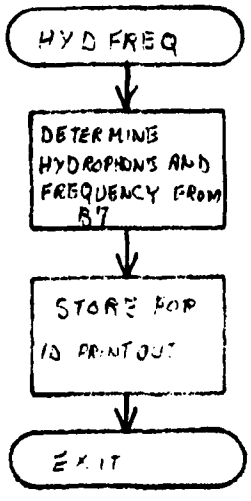
Appendix C

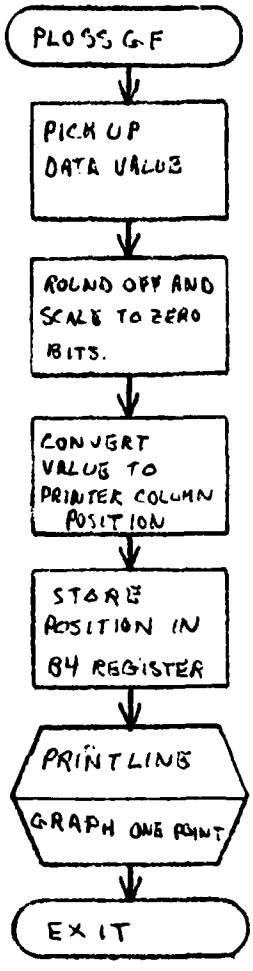
Flow Charts

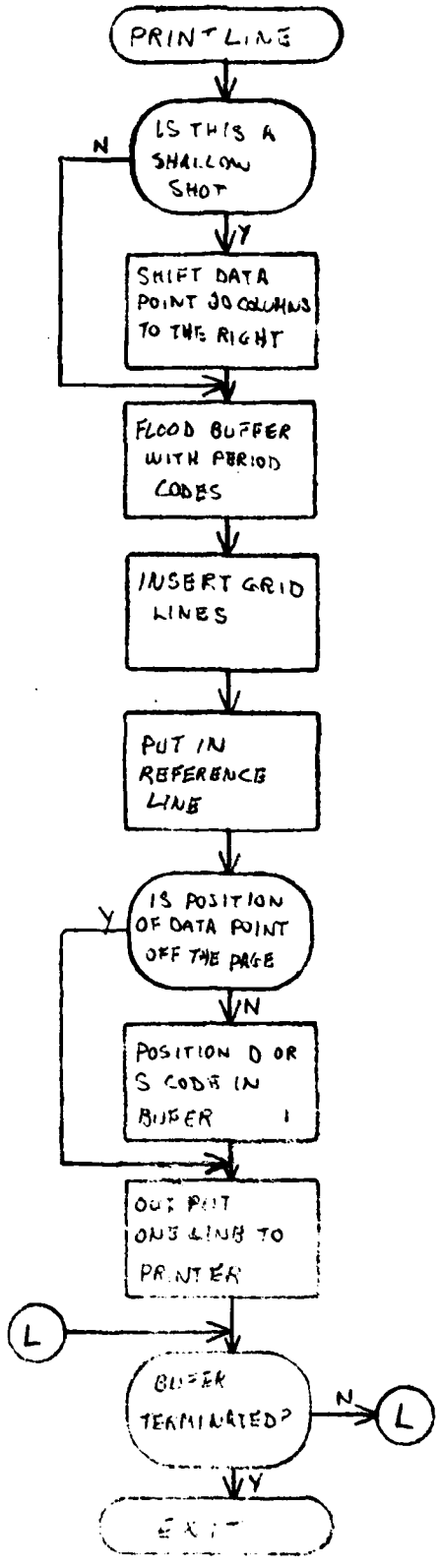

GRAPHIT
LFANDCR
POSITION PRINTER TO COLUMN 1
SET DEEP/SHALLOW FLAG FOR DEEP SHOT
PROPLOSS GRAPH REQUESTED?
Y
B
N
NOISE GRAPH REQUESTED?
Y
M
N
SIGNAL-TO-NOISE GRAPH REQUESTED?
Y
M
N
PROPLOSS DIFFERENCE GRAPH REQUESTED?
Y
M
N
SINGLE PATH LOSS GRAPH REQUESTED?
Y
M
N
A
A
ANGLE OF ARRIVAL GRAPH REQUESTED
Y
M
I
N
RETURN
B
REQUEST CELL TO Q REGISTER
TEST 30 BITS
DETERMINE LOCATION OF DATA
RESTORE REQUEST CELL
HYDFREQ
HYDROPHONE AND FREQUENCY ID
SET CORE ADDRESS OF DATA
C
C
PRINT GRAPH TITLE
PRTHYDFREQ
IDENTIFY HYD AND FREQUENCY
PRTRANGE
PRINT LATEST RANGE
PRTIME
PRINT PRESENT DATE/TIME
SET JUMP-TABLE INDEX
D

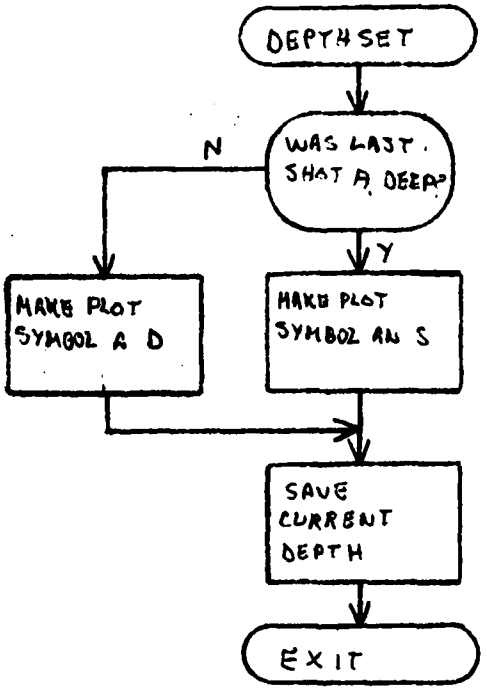

D
CLEAR RECORD AND FILE COUNTERS
E
BACK READ ONE RECORD
END OF FILE?
N
INCREMENT RECORD COUNTER
E
Y
BACK SPACE FIVE FILES
G
READ ONE RECORD
END OF FILE?
N
F
Y
INCRSMENT FILE COUNTER
N
G
Y
H
H
ALL RECORDS IN LAST FILE READ
N
G
Y
RETURN
F
DEPTHSET
SET PLOT SYMBOL TO C OR S
ROTAB
BI
0
PLOSS GF
PROPAGATION LOSS
1
NOISE GF
NOISE
2
SIGNOG GF
SIGNAL TO NOISE
3
PLDIFAR
PROPAGATION DIFFERENCE
J
K
TEST 30 BITS
POSITION REQUEST CELL FOR TESTING
SCAN WORD FOR A SET BIT
BIT FOUND?
N
I
Y
CLEAR BIT
RELATIVE ADDRESS OF DATA TO BE
EXIT

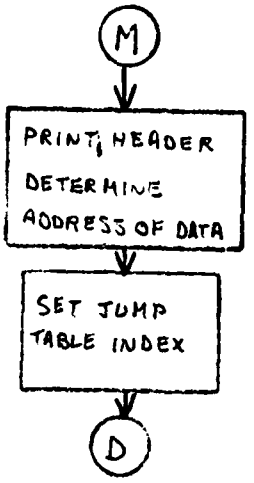

J
K
H
ANGRUGF
ANGLE OF ARRIVAL
S
SIPLOSGF
SINGLE PATH LOSS
LAST FILE
W(BEGOUNT) =6
N
G
Y
DECREMENT RECORD COUNTER
H


HYD FREQ
DETERMINE HYDROPHONE AND FREQUENCY FROM B7
STORE FOR IO PRINTOUT
EXIT


PLOSSGF
PICK UP DATA VALUE
ROUND OFF AND SCALE TO ZERO BITS.
CONVERT VALUE TO PRINTER COLUMN POSITION
STORE POSITION IN B4 REGISTER
PRINTLINE
GRAPH ONE POINT
EXIT


PRINTLINE
IS THIS A SHALLOW SHOT
N
Y
SHIFT DATA POINT 30 COLUMNS TO THE RIGHT
FLOOD BUFFER WITH PERIOD CODES
INSERT GRID LINES
PUT IN REFERENCE LINE
IS POSITION OF DATA POINT OFF THE PAGE
Y
N
POSITION D OR S CODE IN BUFFER
OUTPUT ONE LINE TO PRINTER
L
BUFFER TERMINATED?
N
L
Y
EXIT


DEPTH SET
WAS LAST SHOT A DEEP?
N
Y
MAKE PLOT SYMBOL A D
MAKE PLOT SYMBOL AN S
SAVE CURRENT DEPTH
EXIT


M
PRINT HEADER
DETERMINE ADDRESS OF DATA
SET JUMP TABLE INDEX
D

Appendix D

Program Listing

```
GRAF        ENTRY'SETS GRAPH REQUEST BITS
            RJP*GETMSG
            CL*B1
GRAF11      ENT*A*W(MSGTAB+B1)
            JP*NONGRAF*AZERO'NO MORE REQUESTS
            SUB*A*90
            RJP*MP3*APOS'OP ERR
            ENT*A*290
            SUB*A*W(MSGTAB+1+B1)
            RJP*MP3*ANEG'OP ERR
            ENT*B2*W(MSGTAB+B1)
            ENT*A*W(PLOSS-1+B2)
            ENT*Q*1
            LSH*Q*W(MSGTAB+1+B1)
            SEL*SU*X77777'SET REQUEST BIT
            STR*A*W(PLOSS-1+B2)'STORE REQUEST
            ENT*B1*2+B1'NEXT REQUEST
            JP*GRAF11
NONGRAF     RJP*GRAPHIT'PUT OUT 1 GRAPH
            EXIT
```

```
                PROCEDURE*GRAPHIT
                CLEAR*CR
                CL*W(LSTDEPTH)
                ENT*A*W(PLOS$)*AZERO'WHICH GRAPH
                JP*LPLOSS
                ENT*A*W(NOISE$)*AZERO
                JP*LNOISE
                ENT*A*W(SIG2NO$)*AZERO
                JP*LSIGNOS
                ENT*A*W(DELTAPL$)*AZERO
                JP*LPLDIF
                ENT*A*W(AOA$)*ANOT
                ENT*A*W(AOA$+1)*AZERO
                JP*LABLEAOA
                ENT*A*W(SIPLO$)*ANOT
                ENT*A*W(SIPLO$+1)*AZERO
                JP*LABLESPPL
                RETURN'NO REQUESTS
TEST30BITSENTRY
                CL*A
                LSH*AQ*29D'POSITION FOR TESTING
                RPT*30D
                LSH*AQ*1*ANEG'TEST FOR A REQUEST
                RETURN'NO REQUEST
                SEL*CL*4000000000'CLEAR REQUEST
                LSH*AQ*1+B7'REPOSITION
                EXIT
HYDFREQ         ENTRY
                ENT*A*B7'SHIFT COUNT
                RSH*AQ*30D
                DIV*0
                ENT*B1*A
                ENT*A*L(PHONESHS+B1)
                ADD*Q*1
                STR*A*W(HYDNO)
                STR*Q*W(FREQNO)
                EXIT
PRTHYDFRQ       ENTRY
                CLEAR*24D*PLAB
                FORM-TEXT*PLAB*25D*HYDROPHONE NO'
                FORM-DEC*PLAB*41D*HYDNO
                FORM-TEXT*PLAB*51D*FREQUENCY
                FORM-DEC*PLAB*61D*FREQNO
                ENT*A*PLAB
                MONROE
                EXIT
PRTRANGE        ENTRY
                CLEAR*24D*PLAB
                FORM-TEXT*PLAB*25D*RANGE
                FORM-DEC*PLAB*31D*RANGE
                ENT*A*PLAB
                MONROE
                EXIT
PRTIME          ENTRY
                SIL-EX*SHOTCHAR
                UPTIME
                RIL-EX*SHOTCHAR
                CLEAR*24D*PLAB
```

```
          FORM-TEXT*PLAB*25D*MONTH
          FORM-DEC*PLAB*31D*IMONTH
          FORM-TEXT*PLAB*37D*DAY
          FORM-DEC*PLAB*41D*IDAY
          FORM-TEXT*PLAB*46D*HOUR
          FORM-DEC*PLAB*51D*IHOUR
          FORM-TEXT*PLAB*54D*MINUTE
          FORM-DEC*PLAB*61D*IMINUTE
          FORM-TEXT*PLAB*64D*SECOND
          FORM-DEC*PLAB*71D*ISEC
          ENT*A*PLAB
          MONROE
          EXIT
LPLOSS    ENT*Q*W(PLOS$)
          RJP*TEST30BITS
          STR*Q*W(PLOS$)'RESTORE REQUEST CELL
          RJP*HYDFREQ
          ENT*B7*PLOSSDATA+B7
          STR*B7*L(PLPICKUP)'PICK UP ADDRESS
          CLEAR*240*PLAB
          FORM-TEXT*PLAB*25D*PROPAGATION LOSS VS RANGE
          ENT*A*PLAB
          MONROE
          RJP*PRTHYDFRQ
          RJP*PRTRANGE
          RJP*PRTIME
          CL*L(PLOTIT)'FOR JP TABLE
          JP*GETDATA
LNOISE    ENT*Q*W(NOISE$)'REQUEST CELL
          RJP*TEST30BITS'TEST FOR REQUEST
          STR*Q*W(NOISE$)'RESTORE REQUEST CELL
          RJP*HYDFREQ'STORE HYD AND FREQ NO.
          ENT*B7*NOSDATA+B7
          STR*B7*L(NOSPICKUP)'PICKUP ADDRESS
          CLEAR*240*PLAB
          FORM-TEXT*PLAB*25D*NOISE SPECTRUM LEVEL'
          ENT*A*PLAB
          MONROE
          RJP*PRTHYDFRQ
          RJP*PRTRANGE
          RJP*PRTIME
          PUT*1*L(PLOTIT)'FOR JP TABLE
          JP*GETDATA
LSIGNOS   ENT*Q*W(SIG2:NO$)
          RJP*TEST30BITS
          STR*Q*W(SIG2:NO$)
          RJP*HYDFREQ
          ENT*B7*SIGNOSDATA+B7
          STR*B7*L(SIGPICKUP)'PICKUP ADDRESS
          CLEAR*240*PLAB
          FORM-TEXT*PLAB*25D*SIGNAL TO NOISE
          ENT*A*PLAB
          MONROE
          RJP*PRTHYDFRQ
          RJP*PRTRANGE
          RJP*PRTIME
          PUT*2*L(PLOTIT)'FOR JP TABLE
          JP*GETDATA
```

```
LPLOIF    ENT*0*W(DELTAPL$)
          RJP*TEST30BITS
          STR*0*W(DELTAPL$)
          RJP*HYDFREQ
          ENT*B7*PLOIFDATA+B7
          STR*B7*L(PLOIFPKUP)
          CLEAR*24D*PLAB
          FORM-TEXT*PLAB*25D*PROPLOSS DIFFERENCE
          ENT*A*PLAB
          MONROE
          RJP*PRTHYDFRQ
          RJP*PRTRANGE
          RJP*PRTIME
          PUT*3*L(PLOTIT)
          JP*GETDATA
LABLLAOA  ENT*0*W(AOA$)
          ENT*A*W(AOA$+1)
          LSH*AQ*27D'POSITION FOR TESTING
          RPT*32D
          LSH*A,A*1*ANEG'TEST FOR A REQUEST
          RETURN'NO REQUEST
          SEL*CL*4000000000'CLEAR REQUEST
          LSH*AQ*1+B7'REPOSITION
          STR*0*W(AOA$)
          STR*A*W(AOA$+1)'RESTORE REQUEST CELLS
          ENT*A*B7'SHIFT COUNT
          RSH*AQ*30D
          DIV*6D
          ADD*A*1
          ADD*0*1
          STR*A*W(ARIVLNO)
          STR*0*W(PAIRNO)
          ENT*B7*AOADATA+B7
          STR*B7*L(AOAPICKUP)
          CLEAR*24D*PLAB
          FORM-TEXT*PLAB*25D*ANGLE OF ARRIVAL
          ENT*A*PLAB
          MONROE
          CLEAR*24D*PLAB
          FORM-TEXT*PLAB*25D*ARRIVAL NUMBER
          FORM-DEC*PLAB*41D*ARIVLNO
          FORM-TEXT*PLAB*46D*PAIR
          FORM-DEC*PLAB*51D*PAIRNO
          ENT*A*PLAB
          MONROE
          RJP*PRTRANGE
          RJP*PRTIME
          PUT*4*L(PLOTIT)
          JP*GETDATA
LABLESPPL ENT*0*W(SIPL0$)
          ENT*A*W(SIPL0$+1)
          LSH*AQ*11D'POSITION FOR TESTING
          RPT*48D
          LSH*A,A*1*ANEG'TEST REQUEST BITS
          RETURN'NO REQUESTS
          SEL*CL*4000000000'CLEAR REQUEST
          LSH*AQ*1+37'REPOSITION
          STR*0*W(SIPL0$)
```

```
                STR*A*W(SIPLOS+1)
                ENT*A*87'SHIFT COUNT
                RSH*AQ*30D
                DIV*8D
                ADD*A*1
                STR*G*L(161)
                ENT*G*U(PHONESHS+81)
                STR*A*W(ARIVLNO)
                STR*G*W(HYDNO)
                ENT*87*SPPL+87
                STR*87*L(PLPICKUP)
                CLEAR*24D*PLAB
                FORM-TEXT*PLAB*25D*SINGLE PATH LOSS
                ENT*A*PLAB
                MONROE
                CLEAR*24D*PLAB
                FORM-TEXT*PLAB*25D*ARRIVAL NUMBER
                FORM-DEC*PLAB*41D*ARIVLNO
                FORM-TEXT*PLAB*46D*HYD
                FORM-DEC*PLAB*51D*HYDNO
                ENT*A*PLAB
                MONROE
                RJP*PRTRANGE
                RJP*PRTIME
                PUT*5*L(PLOTIT)
                JP*GETDATA
PLOTAB          0*PLOSSGF
                1*NOISEGF
                2*SIGNOSGF
                3*PLDIFGF
                4*ANGAVGF
                5*SIPLOSGF
GETDATA         CL*W(GFCOUNT)
                CL*W(BRCOUNT)'INITIALIZE
GRAF2           ENT*B4*5'BACK READ
                ENT*B6*4'UNIT 4
                MAGTAPE
                ENT*Q*20'MASK FOR EOF
                ENT*LP*W(STATWRD)*AZERO'EOF/
                JP*GRAF1'YES
                RPL*Y+1*W(BRCOUNT)'NO
                JP*GRAF2'BACK ONE MORE
GRAF1           ENT*B5*4'BACKSPACE 5 FILES
                CL*W(LSTDEPTH)
GRAF3           ENT*B4*6
                ENT*B6*4
                MAGTAPE
                BJP*B5*GRAF3
GRAF4           ENT*B4*1'READ 1 RECORD
                ENT*B6*4'UNIT 4
                IN*TAPE*W(GRAFBCW)
                MAGTAPE
                ENT*Q*20'EOF MASK
                ENT*LP*W(STATWRD)*MNOT
                JP*PLOTIT'NOT EOF
                RPL*Y+1*W(GFCOUNT)
                SUB*A*6'6 FILES FWD/
                JP*GRAF4*MNOT'NOT 6TH FILE MARK
```

```
          GRAF5     BSK*80*W(BRCOUNT)'BRCOUNT EQ 0/
                    JP*GRAF4'NO  KEEP ON
                    RETURN'YES  END IT
          PLOTIT    CL*81
                    RJP*DEPTHSET'PLOTS A D OR AN S
                    RJP*L(PLOTAB+81)
          GRAF6     ENT*A*W(BFCOUNT)
                    SUB*A*6'LAST FILE/
                    JP*GRAF4*ANOT'NO
                    RPL*Y-1*W(BRCOUNT)'YES
                    JP*GRAF5
          DEPTHSET  ENTRY
                    ENT*B5*L(LSTDEPTH)
                    ENT*A*B5
                    SUB*A*27*AZERO'LAST ONE DEEP/
                    JP*MAKEITD'NO
                    ENT*B5*65'S
                    ENT*A*A*SKIP
          MAKEITD   ENT*B5*27'CODE FOR D
                    STR*B5*L(LSTDEPTH)
                    EXIT
          PRINTLINE ENTRY
                    ENT*Q*65'CODE FOR S
                    ENT*Y-Q*L(LSTDEPTH)*ANOT'SHALLOW SHOT
                    ENT*B4*200+B4'SHIFT UP 200B
                    ENT*Q*22
                    RPT*800*ADV
                    STR*Q*W(BF)
                    ENT*B6*100
                    ENT*Q*41
                    RPT*7*ADDB
                    STR*Q*W(BF+B6)'GRID
                    PUT*72*W(BF+400)
                    ENT*A*B4
                    JP*PRT2*ANEG'OFF SCALE
                    SUB*A*800
                    JP*PRT2*APOS'OFF SCALE
                    STR*B5*L(BF+B4)'D OR S FOR DATA POINT
          PRT2      OUT*MONROE*W(BUFLIM)
          PRT1      JP*PRT1*MONO
                    EXIT
          PLOSSGF   ENTRY
                    ENT*Q*214
          PLPICKUP  ENT*A*W(0)
                    ADD*A*4
                    RSH*A*3
                    SUB*Q*A
                    STR*Q*L(164)
                    RJP*PRINTLINE
                    EXIT
          PLOIFGF   ENTRY
          PLOIFPKUP ENT*A*W(0)'DATA
                    ADD*A*4*APOS
                    SUB*A*10
                    RSH*A*3'ROUND OFF
                    ADD*A*400
                    ENT*B4*A
                    RJP*PRINTLINE
```

```
                EXIT
AIRAVGF         ENTRY
AOAPICKUP       ENT*A*W(0)'DATA
                ADD*A*400
                ENT*B4*A
                RJP*PRINTLINE
                EXIT
SIGNOSGF        ENTRY
SNPICKUP        ENT*A*W(0)
                ADD*A*4*APOS
                SUB*A*10
                RSH*A*3
                ADD*A*300
                ENT*B4*A
                RJP*PRINTLINE
                EXIT
NOISEGF         ENTRY
NOSPICKUP       ENT*A*W(0)
                ADD*A*4*APOS
                SUB*A*10
                RSH*A*3
                ADD*A*600
                ENT*B4*A
                RJP*PRINTLINE
                EXIT
                END-PROC*GRAPHIT
PLOS$           0
NOISE$          0
SIG2NO$         0
DELTAPL$        0
AOA$            0
                0
SIPLO$          0
                0
```

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SUBJECT
GRAPHIT - A PLOTTING ROUTINE FOR THE MONROE OPTICAL PRINTER

By D. M. Potter, G. Botseas, and C. J. Becker

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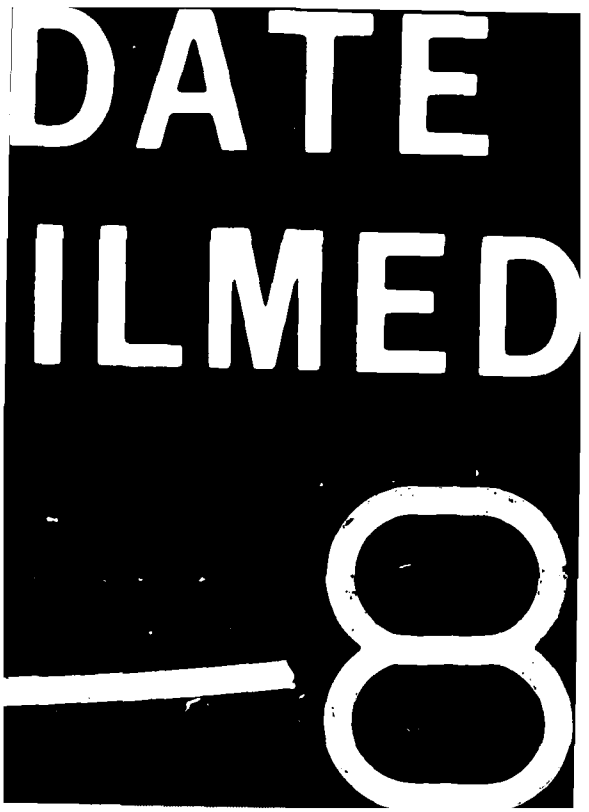
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